

PURCHASE SPECIFICATION FOR PERMANENTLY INSTALLED TACHOMETER SYSTEM

1.0 SCOPE

This specification describes the minimum performance and configuration requirements for a permanently installed tachometer system. The permanently installed components as described in 1.1, along with the accessory equipment required for operation, will be referred to as the tachometer system. The intended use of the tachometer system is to provide a digital RPM indication of the Forced Draft Blower (FDB) speed and a 4-20 milliamperes dc output signal for retransmission compatibility with the pneumatic actuator governor control design.

1.1 System Description. The tachometer system shall consist of three components: the sensor, primary RPM indicator/transmitter and secondary RPM indicator.

1.1.1 Sensor. The sensor shall produce an electrical output signal through the rotation of a rotor piece within a stationary stator assembly. The sensor shall be easily installed on the turbine shaft and blower hub assembly of a Forced Draft Blower (FDB) installed on AOE-1 Class ships.

1.1.2 Primary RPM Indicator/Transmitter. The primary RPM Indicator/Transmitter shall receive an electrical signal from the sensor assembly and provide a linear digital RPM indication of the FDB speed. The primary RPM indicator/transmitter shall also produce an electrical output signal (corresponding to the displayed RPM indication) to a secondary RPM indicator.

1.1.3 Secondary RPM Indicator. The secondary RPM Indicator shall receive an electrical signal from the primary RPM Indicator/Transmitter and provide a linear digital RPM indication of the FDB speed. The secondary RPM Indicator shall also a continuous 4-20 milliamperes dc (made) retransmission output for the shipboard governor control design.

2.0 CONFIGURATION REQUIREMENTS

2.1 Mounting Sensor Installation. The sensor's stator assembly dimensions shall be as appropriate for mounting within the existing FDB shroud. The sensor's rotor piece dimensions shall be as appropriate for mounting on a shaft directly screwed to the FDB turbine assembly.

2.2 Cable Connections. Sensor cable to be minimum length and size to allow passage through the FDB shroud and termination at an electrical junction box (mounted adjacent to the FDB assembly) through connectors/stuffing tube configuration. Arrangement will allow sensor cable to be disconnected and fed through FDB casing allowing removal of existing hub assembly during turbine overhaul.

2.3 Electrical Connections. The tachometer system's primary RPM indicator/transmitter shall be made through MIL-C-5015 style connectors, all located on the bottom of the unit. Three connectors total required for the for the following input/output interface requirements:

- a) Power Input (115v/60Hz) (male connector)
- b) Sensor Input Signal (from electrical junction box) (male connector)
- c) Continuous RS422 or equivalent digital retransmission output for secondary RPM indicator (female connector)

2.4 Primary RPM Indicator/Transmitter. The tachometer system's primary RPM indicator shall be capable of being bulkhead mounted. The maximum dimensions shall be 12 inches high, 12 inches wide and 12 inches deep. The maximum weight of the primary RPM indicator shall be 25 pounds.

2.5 Secondary RPM Indicator. The tachometer system's secondary RPM indicator shall be capable of being flush mounted to the ship's existing control panel. The maximum dimensions shall be 8 inches high, 6 inches wide and 7 inches deep. The maximum weight of the secondary indicator shall be 10 pounds.

2.6 Nonmetallic Materials. Nonmetallic materials used for seals, protective finishes, etc. shall be moisture and flame resistant and shall not support fungus growth.

3.0 PERFORMANCE REQUIREMENTS

3.1 Intrinsic Accuracy. Intrinsic accuracy will be the "as is" delivered accuracy of the tachometer system. The total overall linear accuracy of the tachometer system shall be no greater than $\pm 1.0\%$ of full scale. Accuracy shall be certified by the manufacturer with standards traceable to the National Institute of Standards and Technology (NIST).

3.2 Accuracy Verification. A technique of verifying the accuracy and operation of the tachometer system shall be available without removing the tachometer system from service. This technique should address drift of parameters that will cause a variance of tachometer system performance from the initial set up (i.e. zero shift).

3.3 Visual Indications. The permanently installed tachometer system shall have a RPM indication in accordance with 3.3.1.

3.3.1 RPM Indication. The tachometer system shall visually indicate FDB RPM readings. The RPM indication for both the primary and secondary RPM Indicator shall consist of both a digital and bargraph display. The digital/bargraph display shall be 4 decimal digits with major subdivisions at 1000 rpm increments and minor subdivisions at 200 rpm increments.

3.4 Display Range. The tachometer system shall indicate FDB RPM readings over a speed range of 0 – 10000 RPM.

3.5 Display Update. The display update rate shall be 2 seconds with additional user selectable options at 0.5, 1, 3 and 5 seconds.

3.6 Bi-directional Indication. The tachometer system shall provide an RPM indication with shaft rotation in both a clockwise or counterclockwise direction.

3.7 Signal Retransmission. The signal/accuracy retransmission characteristics of the tachometer system should be maintained (without necessity for adjustment) over shipboard cable runs of 150 ft or less.

3.8 Analog Output. The tachometer system's secondary RPM indicator shall provide a continuous 4-20 milliamperes dc (madc) output signal for the pneumatic actuator governor control design.

4.0 TEST REQUIREMENTS

4.1 Accuracy. The total overall linear accuracy of the tachometer system shall be no greater than $\pm 1.0\%$ of full scale.

4.2 Repeatability. The total repeatability of the tachometer system shall be no greater than $\pm 0.1\%$ of span ± 1 digit.

4.3 Vibration. The tachometer system's primary and secondary RPM indicators shall be tested in accordance with Type I (environmental vibrations) of MIL-STD-167-1. During the vibration test, the RPM indicators shall be operating (power on) and zero RPM condition (for feasibility of test) shall be maintained. The primary and secondary RPM indicators shall be monitored periodically during the test to ascertain the readouts do not change by more than one least significant digit during the test. Operating and maintenance controls shall not change settings. There shall be no evidence of mechanical or electrical damage or loosening of parts. After vibration, the tachometer system shall meet the accuracy requirements of 4.1 without adjustments to controls.

4.4 Shock. The tachometer system shall be subjected to a shock test in accordance with Grade A, Class 1, Type A, MIL-S-901D. There shall be no permanent damage to any of the system components as a result of the shock test. After the shock test the tachometer system shall meet the accuracy requirements of 4.1 without adjustments to controls.

4.5 EMI. The tachometer system shall meet the accuracy requirements when subjected to EMI testing in accordance with MIL-STD-461/462 without adjustments to controls.

4.6 Temperature. The tachometer system shall meet the accuracy requirements when subjected to operating ambient temperatures of 0 to 50 degrees C.

4.7 Enclosure. The tachometer system's primary and secondary RPM indicators shall be subjected to the splash-proof test specified in MIL-STD-108. Accumulation of water within the equipment enclosure or failure of the equipment to operate satisfactorily shall be cause for rejection.

4.8 Waiver Requests. The test criteria outlined in paragraphs 4.1 through 4.7 above may be waived if an offeror can demonstrate the tachometer system it intends to furnish, or similar system, has successfully met each of these requirements.

5.0 SERVICING

5.1 Servicing. Parts and subassemblies of the tachometer system that may require repair or replacement shall be readily accessible.

5.2 Replacement Parts and Subassemblies. Replacement of parts or subassemblies that do not contain stored calibration settings shall not affect the calibrated accuracy of the tachometer system.

5.3 Maintenance and Repairs. Construction of the tachometer system shall facilitate disassembly, location of trouble sources, maintenance, assembly and calibration without the aid of special tools.

5.4 Warranty. A minimum one-year warranty shall be provided for the tachometer system and its associated parts. The manufacturer shall warrant the tachometer system against defects in material and workmanship. During the warranty period, the manufacture will correct defects by restoring the tachometer system to its normal operating condition as determined by the performance requirements of this purchase specification.

5.5 Upgrades. Component upgrades (including software and hardware), which improve the accuracy or reliability of the speed measurement, shall be supplied to the Navy during the one-year warranty period at no cost to the government.

5.6 Components. All parts/components of the tachometer system shall be covered under the one-year warranty. Broken parts that are not the result of misuse, abuse or negligence by government employees shall be repaired or replaced by the manufacturer at no cost to the government.

5.7 Technical Support. The manufacturer shall provide technical support to the government throughout the operational life of the tachometer system. The operational life shall be as long as the tachometer system is in service. The technical support shall be conveyed through commercial telephone lines during the manufacturers normal business hours.

6.0 ACCESSORIES

6.1 Technical Manuals. One technical manual shall be provided with each tachometer system. The technical manuals shall discuss theory of operation, operating procedures and troubleshooting methodology. The technical manuals shall conform to the manufacturer's standard commercial format.

6.2 Spare Parts Inventory List. The manufacturer shall supply an inventory list of recommended spare parts to be maintained by the Navy to support the tachometer system.

7.0 DELIVERY REQUIREMENTS

7.1 Delivery shall be accomplished in accordance with the following schedule:

<u>Item</u>	<u>Description</u>	<u>Quantity</u>	<u>Delivery</u>
0001	Digital Tachometer System, in accordance with attached specification.	8	60 days after award of contract
0002	Technical Manual for Digital Tachometer System, in accordance with paragraph 6.1 of attached specification.	8	With delivery of item 0001
0003	Test Report verifying requirements specified in section 4.0 of attached specification.	1	With delivery of item 0001
0004	Spare Parts Inventory List, in accordance with paragraph 6.2 of attached specification.	1	With delivery of item 0001

PROCUREMENT ADDENDUM

As part of any quotation offerors shall provide the following information in order to determine that the tachometer system to be furnished will comply with the requirements set forth in the purchase specification:

1. Information on the Tachometer System the offer intends to furnish demonstrating that the system will meet the configuration, performance and test requirements of the purchase specification.
2. If a waiver of testing is requested, information demonstrating the tachometer system to be furnished (or similar system) has successfully met the requirements set forth in section 4.0 of the purchase specification.